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Non-ferrous Foundry Research

We, in common with the whole of the non-ferrous foundry industry, are desirous of associating ourselves with the congratulations which have been received by the British Non-ferrous Metals Research Association upon the attainment of their twenty-fifth birthday. This event was celebrated at a luncheon party held at the Savoy Hotel last week. It was honoured by the presence of two Ministers of the Crown, Mr. Herbert Morrison, Lord President of the Council, and Sir Stafford Cripps, President of the Board of Trade. Sir John Greenly, who presided, recalled the excellent spade work done by the founder, the late Mr. Thomas Bolton. We recall a private conversation we had with the deceased gentleman many years ago, at which we deplored the neglect by the B.N.F.M.R.A. of foundry interests. His reply was that the Association had at that time quite inadequate support from our industry and therefore finance was lacking, but he assured us such work was constantly in the mind of the Council. How true that was has been well shown, for, in recent times, quite a serious percentage of the researches published have dealt with foundry practice.

We were impressed by the remarks made by Sir Stafford Cripps, who, by the way, was at one time a research worker. *Inter alia*, he pointed out that it was quite insufficient for firms to pay an annual, even though adequate, subscription to a co-operative research association and then await publication of results. Members must use the resources of the association constantly. To us it is obvious that, should Sir Stafford's advice be taken seriously, the scientific staffs of the associations would have a much better knowledge of what the industries they serve, lacked in technical knowledge and equipment, and on this basis could so orient their researches as to be of the greatest benefit to the members as a whole. It should be borne in mind that directors are only human, and that they aim to satisfy the needs of their keenest supporters—not necessarily financial—but potential publicists for the work they are doing. Sir Stafford also emphasised the need for a greater inflow of scientists in the research organisations and commended an extension of the Birmingham University scheme, which has this object well to the fore.

To the credit of the B.N.F.M.R.A. goes the invention of the L-Delay—a delayed action bomb which was used on every front during the war. This material contribution to the war effort was made because of the success attending the efforts of the director and council to maintain the staff intact. This difficulty was most unfortunately not overcome by all the research associations, and peace has not so far ameliorated conditions to any marked extent, as good scientists with the requisite training and knowledge are, as Sir Stafford pointed out, difficult to come by. Mr. G. L. Bailey, the newly appointed director, has already shown his sincere appreciation of the necessity for research into the fundamentals of foundry practice, and for him and his staff we ask for the close and complete co-operation of all non-ferrous foundry owners. We feel sure he will deliver the goods.

THE AUGUST/SEPTEMBER ISSUE of the "Nickel Bulletin" contains numerous abstracts of current interest, including the new B.S. specification for electro-deposited nickel and chromium coatings and an account of American work on the effect of surface finish on electrodeposited coatings. Other work deals with permeability measurements, impact testing of cast iron, high-temperature uses of cast iron, American specifications for stainless-steel tubing, welding of Hastelloy and temper colours and spot tests for stainless steel. Copies may be obtained, free of charge, from the Mond Nickel Company, Limited, Grosvenor House, Park Lane, London, W.1.

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NOTES FROM THE BRANCHES

NEWCASTLE-UPON-TYNE BRANCH.—Mr. Burrows, in his inaugural address, dwelt on the changes which have taken place in the branch during the past few years. Whilst thanking members for honouring him by electing him to the office of branch-president, he felt that he had stepped into the position owing largely to the resignation of more worthy members, and wished he could be assured that the elected senior vice-president had been there to take his position. However, he wanted to assure the members that it would be his constant endeavour to do everything possible to uphold and further the traditions and the high aims of the Institute, and in particular the Newcastle branch.

Mr. Burrows emphasised that Tyneside stands out in the annals of industrial history for all that is great in engineering achievement, and he felt sure that the foundrymen on Tyneside could claim their share of pride in being responsible to a large extent for many outstanding and notable engineering triumphs. Castings at the present time were being made to more rigid specifications and exacting details, and had to be produced to meet more severe competition than at any time in the past. To produce such castings demanded the highest skill and technical knowledge. The days of rule-of-thumb methods were gone, and the motto of the Tyneside foundrymen was and must continue to be "science hand in hand with industry."

"This," said Mr. Burrows, "is where the Newcastle branch must come into the picture." The meetings which would be held during the present session were intended to give the opportunity of free and open discussion on all matters relating to the foundrymen's craft—an arena where moulder and designer, pattern-maker and draughtsman, cupola man and chemist, could thrash out their differences of opinion, learn to understand and appreciate the difficulties of all and co-ordinate their specialised knowledge into a positive plan of campaign. Mr. Burrows especially stressed the importance of younger members entering into the discussions. He hoped that by that means a spirit of enthusiasm would become apparent, and that by the ready exchange of knowledge, combined with a desire to improve and perfect individual capabilities, they might travel along the road of progress to the success which never before in history had been so essential as at the present time.

Following the presidential address, three short Papers, intended to provoke discussion, were read. The first dealt with non-ferrous materials, and was presented by Mr. G. Elston, who stated that in opening the talks to be given he felt it was necessary to explain that the idea of devoting approximately one hour to the treatment of three subjects, each of which offered sufficient scope to represent a life study, was to show up in relief some of the practical considerations and divergences which exist in the founding of these materials. A second Paper, read by Mr. Norman Charlton, was confined to cast iron, and similarly the third, by Mr. J. Hetherington, dealt entirely with cast steel.

PUBLICATIONS RECEIVED

Data Sheets for Calculating Additions of Ferro-alloys. Data sheets with charts indicating a simple way to calculate additions of ferro-alloys to iron and steel are now available from St. Lawrence Alloys & Metals, Limited, Beauharnois, Quebec, Canada. Each of the eight data sheets available describes one of the chromium, manganese, or silicon alloys available from St. Lawrence, and contains a chart with instructions showing how to make simple, rapid, and accurate calculations on alloy additions. These data sheets, part of a series of technical publications prepared by St. Lawrence Alloys & Metals, Limited, include charts printed in two colours to facilitate calculations in either the English or metric systems. All are punched for convenient binding. Copies of these sheets will be sent to those concerned with the use of ferro-alloys or alloying metals.

Tin and Its Uses, No. 16. This house organ, published by the Tin Research Institute, describes improved methods of casting bronze in metal moulds for subsequent hot and cold working, which permit the production of 100 per cent. sound bronze of the highest quality, even when scrap metals are used. New processes for tinning cast iron without preliminary electroplating have solved a number of industrial problems. This development will provide a better finish on cast-iron mincers, saucepans, and other food handling apparatus. The process has been successfully applied to equipment used in the manufacture of penicillin, after the failure of conventional methods. "Tin and Its Uses" may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

The Equilibrium Diagram of the Aluminium-magnesium Systems. This (No. 5) is the latest addition to the Institute of Metals' Annotated Equilibrium Diagram Series, and has been compiled by G. V. Raynor, M.A., D.Phil. It contains the diagram reproduced on a generous scale, and based on what is regarded as the most reliable work in each phase field; a table giving all important data connected with the diagram; a number of critical notes, and a list of reference. Copies of all the booklets in the series are still available, price 6d. each, post free. They deal respectively with the aluminium-zinc, copper-tin, copper-zinc, and copper-aluminium systems, and may be obtained from the Institute of Metals, 4, Grosvenor Gardens, London, S.W.1.

Steel Horizons. The third quarterly issue of this colourful house organ, published by the Allegheny Ludlam Steel Corporation, of Brackenbridge, Pa., U.S.A., contains a most interesting article on television, as well as a number of illustrated accounts of works and industries which use stainless steel in their daily routine.

Sif-Tips. The house organ of the Suffolk Iron Foundry (1920), Limited, of Stowmarket, carries in its latest issue (Vol. 9, No. 53) a good article on the low-temperature welding of aluminium.

A NEW METHOD OF FEEDING APPLIED TO CASTINGS MADE IN STATIC MOULDS*

A study of one of the most recent advances in the production of castings

By S. T. JAZWINSKI, Dpl.-Ing. Met., and S. L. FINCH†

INTRODUCTION

In the early days of steelfounding, when the craftsman was the only source of knowledge, large feeder heads utilising gravity pressure only were used to produce sound castings. This resulted in a low yield of castings from liquid metal with uneconomic production and low unit productivity per man-hour. Frequently, castings were unsound, even though fed with large heads, due to lack of understanding of the physical laws governing solidification and shrinkage in castings. Alternatively, in a desire to achieve greater economy, many castings have been made with a reasonably high yield, but without proper compensation for liquid shrinkage, resulting in a certain degree of unsoundness. With the advent of science into the modern foundry, combined with the valuable experience of past work, balanced methods of feeding, directional solidification, and applied pressure have all been studied and used in the foundry. Where a thorough understanding of the basic laws has been achieved, castings are produced at a more economic figure, and are equal if not superior in quality to those produced in the past.

This article is limited to a study of one of the most recent advances in the production of castings, and is an attempt to illustrate the effect of one variable factor, whilst others were kept as constant as was practicable. A few years ago the Williams' riser, scientifically studied by Taylor and Rominski,[1] showed the value of increased pressure in a feeder head. At the same time, centrifugal casting methods were being evolved which resulted in higher yields and consequent saving in feeder heads. Unfortunately, this last method of applying pressure required relatively expensive plant, equipment, and maintenance; nevertheless, the great increase in yield has compensated for this outlay in capital. One drawback of the centrifugal method is that it is limited in its application, although the range of castings made by this method has been increased in recent years.

An elementary deduction is, that to increase the yield of castings, one must obey all the basic laws and, in addition, they must be applied in such a way that the waste metal forming the feeder head is reduced to a minimum. One can observe that, keeping every other factor constant, increase in yield can be obtained by increasing the pressure from gravity pressure through atmospheric pressure to centrifugal pressure. The logical conclusion now drawn is, that if this pressure is further increased, then a relative increase in yield is obtained.

*Patents applied for in all countries.

†The Authors are respectively chief metallurgist and foundry methods engineer, K. & L. Steelfounders & Engineers, Limited, Letchworth.

Preliminary Work

In the preliminary steps of this work, many heads were sectioned and the type of shrinkage cavity and its history noted. There is no doubt that the type of shrinkage cavity obtained is one of the most informative features, an aspect which has been neglected in the past in foundry technology. If standard conditions are observed, the character of the shrinkage is governed by the pressure. All gravity heads tend more or less to have a carrot-shaped cavity extending deep down the head, with a considerable amount of secondary piping.

Atmospheric heads have a cavity slightly more globular in shape and little, if any, secondary piping. In the case of a centrifugal casting, where the head and runners are one unit, there is definite trend for the cavity to be flat-bottomed.

The height of a feeder head necessary is determined by the length of shrinkage cavity, and consequently, if the cavity is globular instead of carrot-shaped, a constant volume of casting will require less of head height, and will result in an increase in yield. In previous experiments,[2] using graphite rods, a perfectly flat-bottomed cavity was obtained in one of the feeder heads. General observations made led to the assumption that pressure was being exerted, causing this unusual type of shrinkage cavity.

When the relationship between the types of shrinkage cavity and applied pressure was established, it became clear that one must look from an entirely new aspect on the formation of shrinkage cavities in feeder heads. This deduction was followed by a series of experiments, and it was found that the size and type of shrinkage cavity formed in the feeder head were proportional to the pressure applied. Under gravity or even atmospheric pressure, the formation of the shrinkage cavity is the result of a complicated series of changes to which a number of physical properties contribute, and, of these, pressure is of paramount importance. In the experiments there were many instances where the pressure was in excess of even that obtained in centrifugal castings. These conclusions and experimental evidence led to a new method of casting, with a greater pressure in the feeder heads giving greater soundness with a much higher yield than normally obtained.

Atmospheric Heads

Orthodox (gravity) or atmospheric heads require maximum fluidity to fill all parts of the mould if the casting is to be perfectly sound. It is well known that it is very difficult to control this feeding, even when all the fundamental laws of feeding are observed. In addition, the yield is low using gravity heads, and although higher when using the atmospheric type, the

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amount of metal in the feeder heads is still greatly in excess of the theoretical amount required. Naturally the maximum yield which can be obtained is limited by the existence of various factors, such as radiation and conduction losses and lateral solidification of the head. Due to these, and other factors, some metal must be supplied in excess of the theoretical amount required to compensate for liquid shrinkage. All the experiments detailed in this article have been made with steel castings, but the same principles are applicable (to a greater or less degree) to other metals and alloys. Volume changes which occur in liquid steel before and during solidification are rather pronounced.

At 20 deg. C. density is 7.875 g. per c.c.
At 1,530 deg. C. density is 7.126 g. per c.c.

The influence of the elements, like carbon, silicon, manganese, phosphorus, etc., cannot be overlooked, as these increase the above-mentioned figures.

The most reliable experimental data give an average shrinkage in passing from the liquid to solid state of 3 per cent. Obviously a casting temperature higher than that at which freezing commences must be used, and this increases *pro rata* the amount of liquid shrinkage for which provision must be made, and in practice it has been found that a figure of 6 per cent. is sufficiently reliable to be used for total liquid shrinkage.

Liquid metal must be supplied to the solidifying casting to compensate for liquid shrinkage. This metal is supplied by the feeder heads into the casting. Existing methods are three types of combinations of these three types of forces, namely, gravity, atmospheric pressure, and centrifugal pressure developed in a rotating mould. If the pressure is high enough to

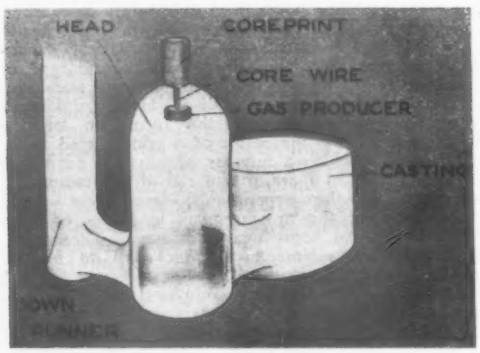

FIG. 1.—INTRODUCTION OF KAYELL COMPOUND INTO FEEDER HEAD.

force the metal from the feeder head to the casting and at the same time form a flat-bottomed cavity in the head, then the feeder head can be reduced to a minimum, resulting in a very high yield. The experiments which are described prove this point, and as a result castings were made with exceptionally high yields, some up to 95 per cent.

T-shaped Sections Used

The investigations were made particularly on castings having "T" sections, which, when made by existing methods of feeding, show a tendency to have small cavities or porosity at the junction of the section. By existing methods of feeding this design has always been considered detrimental to the production of sound castings, but it appears that when using high pressure in the feeder head, shrinkage cavities can be overcome. The laws of directional

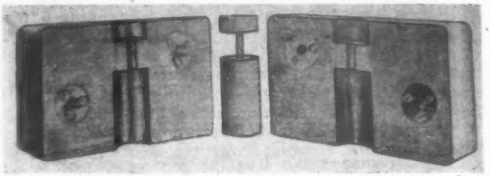

FIG. 2.—SHOWING COREBOX AND CORE.

solidification must be obeyed if the head is to be the last to solidify. In this respect it would appear essential to introduce into the feeder head a sufficient amount of heat so that the head can retain its fluidity much longer than is the usual practice.

This would mean that any pressure developed would be exerted on a whole liquid surface, and not on a portion of the liquid centre, as has been the case in previous existing methods. It is clear that (*a*) pressure must be applied and (*b*) a liquid interior in the head must be maintained for a long time if a maximum yield and minimum waste are to be obtained. These ideas, conclusions, and experimental evidence led to the discovery by the Authors of the new method of feeding, namely, "Gas Pressure Feeding." This consists of casting metal in moulds having one or more feeder heads in which there is introduced into the feeder head before casting a charge of a material adapted, after a surface skin or envelope of solid metal has formed in the feeder head, by cooling, to create a gas, the pressure of which will act upon the liquid metal to force it into the mould in which the casting is formed.

Additionally there can also be introduced an exothermic composition such as a mixture of iron oxide and aluminium. The amount added is sufficient to create a certain amount of heat to compensate conduction and radiation losses. The gas and heat evolution compound is, for simplicity throughout this article, called "Kayell" compound.

Normally the compound producing gas and head is contained in a refractory or other container, adapted to withstand head of the liquid metal for a certain time, thus preventing the heat of the liquid metal from acting on the compound until such time as an

air-tight frozen envelope has been formed in the feeder head These two factors, pressure and heat, result in a globular cavity with a meniscus inside the feeder head. This article describes the conditions under which it is possible to make castings with this new method of feeding, and many examples of castings made by this method are given.

MECHANISM OF METAL SUPPLY FROM A FEEDER HEAD AND THE TYPE OF CAVITY FORMED

Method of Introducing the Compound which Evolves Gas and Heat in the Head

The introduction of the mixture into the feeder head is made in a simple manner, and is shown in Fig. 1. This method consists in having a special core made which is easy to manufacture in everyday practice. The corebox shown open in Fig. 2, with the completed core, illustrate the method used, and the article is fastened in the mould, as shown in Fig. 1. From this illustration it can be seen that the gas compound hangs 1 in. from the top of the head, suspended by means of a small wire, which in its turn is attached to a core print which fits tightly in the mould.

When the head is completely filled with liquid steel the gas compound is surrounded on all sides by liquid metal. The head is almost immediately enclosed by a gas-tight container of solidified steel. This thin skin or shell is formed by the sudden chilling action of the relatively cold mould. The object is to have the gas compound suspended as near to the top of the feeder head as possible, while at the same time the method of suspension must isolate this compound from the mould.

Shortly, this compound is surrounded by liquid metal, the exothermic reaction begins, and gas and heat are evolved. The heat is absorbed by the metal in the immediate vicinity, and the gas evolved is trapped in the thin shell of metal enclosing the head. Both quantity of gas and heat evolved can thus be introduced simply and practically at little cost, but before showing the action of both gas and heat the method of controlling these two important factors is reviewed.

Control of Applied Pressure

In the early stages of development several gas and exothermic compounds were made, which for simplicity are called Kayell 1, Kayell 2 . . . Kayell X. The amount of gas evolved was estimated by the apparatus shown in Fig. 3, 0.1 gm. of the sample was placed in a combustion boat, and the latter in a silica combustion tube. The air in the apparatus was then replaced by carbon dioxide given off from the flask containing sodium bicarbonate. When this was completed, the combustion tube was heated to approximately 900 deg. C. At the same time the sodium bicarbonate was heated gently, so that a steady flow of carbon dioxide was obtained. As the mixture decomposed

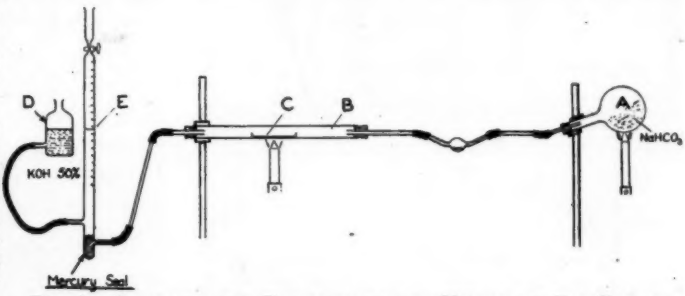

FIG. 3.—APPARATUS FOR DETERMINATION OF VOLUME OF GAS EVOLVED BY KAYELL COMPOUND.

hydrocarbons and a little carbon monoxide were given off. All the gases were collected in a eudiometer above a 50 per cent. potassium hydroxide solution. The residual gas was in its turn washed out with carbon dioxide.

The whole operation lasted about 30 min., after

TABLE 1.—*Relation Between Different Kayell Compositions and Gas Evolutions.*

Composition No.	1	2	3	4	5	6	7	8	9	10
Gas evolved, c.c. at N.T.P. from 1 gm.	11.5	21.5	28.0	29.2	31.0	31.5	33.5	34.0	35.3	36.0
Gas evolved, c.c. at 1,500 deg. C. CP = 76 oms. Hg.	63.2	118.0	154.0	160.2	171.5	173.5	184.0	187.0	194.1	198.0
Composition No.	11	12	13	14	15	16	17	18	19	20
Gas evolved, c.c. atN.T.P.	43.5	55.0	59.0	61.0	62.0	76.0	109.0	152.0	204.0	222.0
Gas evolved, c.c. at 1,500 deg. C. CP = 76 oms. Hg.	239.0	303.0	325.0	335.0	342.0	417.0	599.0	835.0	112.0	122.0

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which the eudiometer was disconnected and the readings taken after a further 20 min. At the same time the temperature and pressure were noted. The readings obtained were corrected to N.T.P., and an allowance was made for the saturated vapour pressure of water. The corresponding values of the correction factor can be found in physical constant tables. Every

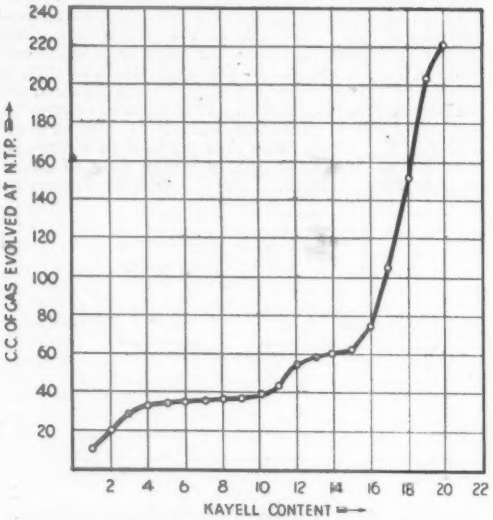

FIG. 4.—SHOWING RELATION BETWEEN KAYELL CONTENT AND AMOUNT OF GAS EVOLVED.

determination was made under these standard conditions, as even taking all precautions the experimental error amounts to plus or minus 5 per cent. of the determined figure.

The results obtained are included in Table I. All the determinations were corrected to N.T.P., but as the actual conditions are between 1,500 to 1,550 deg. C., the volume at that temperature was calculated from the formula:

$$\frac{1}{273} \times T \times A = X$$

where T = 1,500 deg. C.

A = amount of gas in c.c. evolved from 1 gm. of mixture at N.T.P.

X = amount of gas in c.c.s. evolved from 1 gm. of mixture at 1,500 deg. C.

Having obtained the results shown in Table I, the graph shown in Fig. 4 was drawn, and the remainder of the experiments were completed, using the graph.

Using Fig. 4, four mixtures were taken on which further experiments were conducted. The results obtained on a series of experiments are shown in Fig. 5. Comparing sample 3 with sample 15, whilst the former pressure was not sufficient to give a sound casting, the latter pressure proved to be so great (approximately 300 lbs. per sq. in.), that the metal burst through the solidified skin and lifted the mould. No. 15 was produced using Kayell 20 and No. 3 using Kayell 2 composition. It became apparent that it was necessary to employ composition with a gas evolution higher than Kayell 2, or, if using Kayell 20, a means for delaying the pressure action would have to be used so that the skin surrounding the head would be sufficiently strong enough to resist this exceptionally high pressure. Experiments were then conducted to determine the best and most economical method of delaying the pressure action.

Method of Delaying the Action of Gas Pressure

The success and advantages obtained when using gas pressure are dependent on the formation of a thin solid shell of metal around the head, so that the pressure is exerted at the right moment in a closed container. This experimental evidence led the Authors to develop various means of delaying the pressure action so that a comparison could be made from three points of view, namely: (1) success; (2) economic, and (3) practicability. The three chief methods experimented

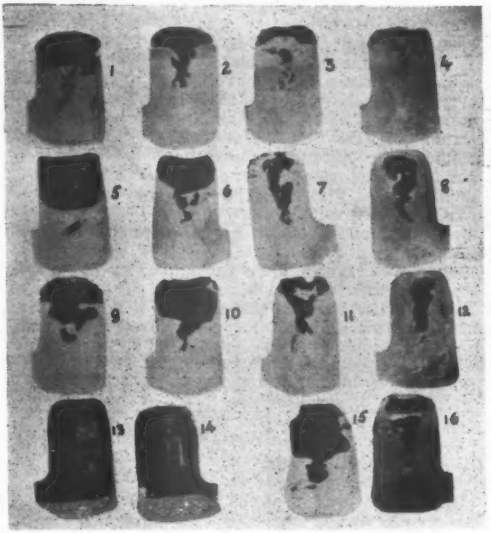

FIG. 5.—SECTIONED HEADS SHOWING DIFFERENT DELAYING AND PRESSURE ACTION.

with were (*a*) enclosing the compound in a copper tube; (*b*) enclosing in a steel tube; and (*c*) coating with a

thick refractory paint. These three were compared with an unprotected compound capsule.

In Fig. 5 are 16 heads produced using four different mixtures and the three methods of delaying the pressure action and one unprotected. The vertical rows are representative of different delaying actions, whilst the horizontal rows are representative of various Kayell compounds.

First row vertical (heads 1, 5, 9, 13).—Steel case used for delaying action.

Second row vertical (heads 2, 6, 10, 14).—Copper case used for delaying action.

Third row vertical (heads 3, 7, 11, 15).—Refractory paint.

Fourth row vertical (heads 4, 8, 12, 16).—No protection at all.

First row horizontal (heads 1, 2, 3, 4).—Kayell (2) composition.

Second row horizontal (heads 5, 6, 7, 8).—Kayell (4) composition.

Third row horizontal (heads 9, 10, 11, 12).—Kayell (6) composition.

Fourth row horizontal (heads 13, 14, 15, 16).—Kayell (20) composition.

On each horizontal row (see Fig. 5) the size of the cavity is seen to increase as the delaying action is decreased, and using the same delaying action (see vertical rows) the cavity increases as the gas evolution increases. Briefly, the action is that immediately the metal fills the head, a chilled skin forms a chamber in which any gas given off causes an immediate

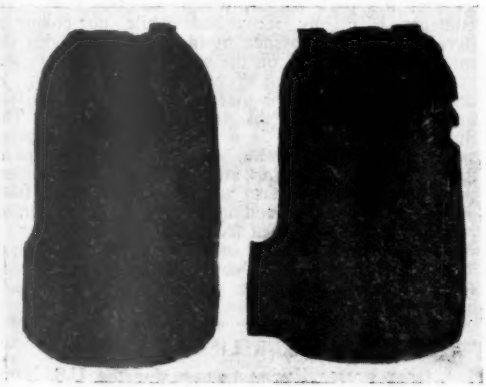

FIG. 6.—SHOWS A COMPARISON BETWEEN THE TYPE OF CAVITY AND MACROSTRUCTURE IN AN ATMOSPHERIC HEAD (LEFT) AND GAS-PRESSURE HEAD (RIGHT).

pressure, resulting in more efficient feeding. The mixture is so made that an exothermic reaction occurs at the same time as the gas evolution takes place. This exothermic reaction prolongs the active life of the head, resulting in increased feeder efficiency. As can be seen from the experimental work carried out, this pressure can be controlled by quantity and composition of the mixture, and, in addition (as has been shown), the amount of head metal subject to pressure can be controlled by using various delaying actions.

For example, the actual pressure which is developed has been calculated for No. 8, Fig. 5, where the volume of cavity is 300 c.c.s. The compound used in this particular case was Kayell 4, which from

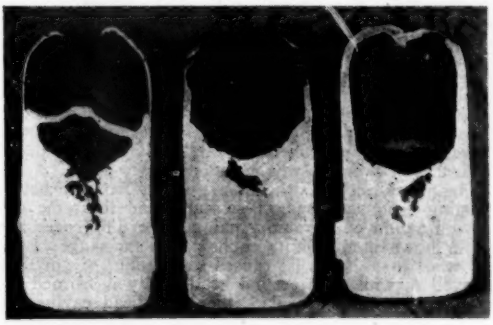

FIG. 7.—SHOWING SECTIONED HEADS WITH VARYING GAS PRESSURE.

Table I evolves 160 c.c.s. of gas per gm. at 1,500 deg. C. The standard weight of the gas compound used was 10 gms.; therefore, the gas evolved is in the region of 1,600 c.c.s., which meant that the actual pressure developed was equivalent to approximately 5 atmospheres (75 lbs. per sq. in.). The pressure obtained can, from the figures in Table I and the volume of cavities obtained, be calculated in each case.

Having established the theory in practice, much further detailed experimental work was done before the conclusions drawn were applied to actual castings.

Type of Cavity Formed

The cavity formed in the feeder head differs greatly from the usual type in its formation because of the effect of gas pressure and internal heat evolution. These two factors are the reason for this type of cavity and, due to the fluidity of the interior being maintained for a longer period of time, and the pressure being applied to the whole surface of the liquid interior of the head. As a result of these two factors the cavity is globular in shape, and the great pressure on the whole liquid surface causes a meniscus to be formed. This is illustrated in Fig. 6, which shows a comparison between the cavity formed in an atmospheric head and a gas-pressure head. In the former case the cavity is carrot-shaped, but is more compact than the cavity in the same type of head which utilises ferro-static pressure only. The gas-pressure head (right in the illustration) shows the

A New Method of Feeding

globular shape of the cavity, occupying the top portion of the head with some secondary piping situated immediately below the semi-spherical gas cavity. This factor is the most important in determining head height so that one can procure a sound casting using the minimum height of head. A pronounced meniscus is shown in the head on the right, Fig. 6, a phenomenon unknown in feeder heads before. Macro-etching of the heads shows differences in the crystal formation. In the atmospheric head columnar crystals are more pronounced and the direction of the ingrowing crystals is towards the centre of the head and toward the last part of the head to solidify. In the case of the gas-pressure head, however, the columnar crystals are not so pronounced and the macrostructure gives evidence of finer crystals without any special orientation over the whole pattern.

In Fig. 7, sectioned heads are shown from an actual casting using varying gas pressures and the same delaying action of refractory paint. The differences are well shown in the photographs. The shrinkage cavity in the first head is caused by using 4 gms. of Kayell 6, whilst the second head cavity is formed by using 7 gms. of Kayell 6; the third head cavity was

FIG. 8.—SHOWING SECTIONED HEADS WITH DIFFERENT DELAYING ACTION.

formed using 10 gms. of Kayell 6. Using the lower pressure caused a globular cavity which gradually changed to a blunt carrot-type cavity, whilst the high pressure gave a more flat-bottomed cavity with very little secondary piping. The possible saving in the head metal over the orthodox type of the head is obvious.

The methods for delaying the gas-pressure action have been discussed and an illustration of the effect of one of these is shown in Fig. 8. This type of head had a double neck, which accounts for the unusual shape of the lower portion of the head. The delaying action was controlled by packing a known weight of the compound in a steel tube. When the lower portion of the tube melted, the compound began to react, evolving gas and heat. The result of the reaction was to produce the cavity as shown in Fig. 8. In the centre head one can see a wire extending from the metal shell into the interior of the head. This was done to determine whether the protruding portion of the wire would remain unmelted and prove suitable for use in production purposes as a means of supporting the gas compounds. As will be seen from this figure, the wire remained unmelted and proved that the pressure pushed the metal quickly away from the top portion of the head. This method of wiring the compound to the core print was used for all future work.

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(*To be continued.*)

RAPID SPOT TEST FOR NICKEL

All of the available spot test methods for nickel indicate the presence of nickel, but the characteristic red spot is partially obliterated by a dark brown stain, particularly where the nickel content is low. In a new test devised by British Timken, Limited, the customary brown stain has been eliminated so that the pink colour, which indicates low nickel contents, is plainly recognised, while no colour is developed in the absence of nickel. In applying the method, a small area on the steel is cleaned of grease, rust or scale, by filing or grinding, if necessary. A drop of acid solution is placed on the cleaned surface and allowed to attack the steel for about 10 sec. The drop is then absorbed in a small strip of filter paper which is allowed to remain on the steel. Two drops of dimethylgloxime solution are applied to the spot on the paper, which will turn various shades from a faint pink to a dark red depending on the nickel content, or remain colourless if free from nickel. Particulars of the solutions are included in a Paper on "Rapid Spot Test for Nickel in Steel," by E. R. VANCE and H. S. GONSER, published in the "Iron Age" for September 13.

LARGE STRESS-RELIEVING FURNACE

A large stress-relieving furnace for the U.S. Navy Department is being built by Rust Furnace Company, Pittsburgh, Pennsylvania. One of the largest ever designed, the new furnace will be a portable unit, capable of being readily dismantled and reassembled in different locations. It is intended for Hunters Point, California, for stress-relieving the heaviest battleship turrets. The furnace will be 48 ft. wide by 56 ft. long by 30 ft. high, indirect-fired with forced recirculation of hot gases, and equipped with two outside independent combustion chambers and two recirculating units.

COST AND TECHNICAL CONTROLS IN THE FOUNDRY

MEANS OF ATTAINING GREATER EFFICIENCY

By E. W. HARDING

The trouble about efficiency in the foundry is that it is usually nobody's business. On the one hand, there are the practical men, foremen and metallurgists, whose primary concern is to meet production demands. On the other side is the cost accountant, concerned solely with cost comparisons, and usually unfamiliar with production problems. Co-ordinating the two is the foundry or works manager, who depends upon the cost and technical men to inform him of the true state of affairs, and particularly as to the correct interpretation of the facts.

Who is to decide, for example, how much coke should be used in cupola melting? The metallurgist, who is concerned primarily with quality and only secondarily with cost; or the cost accountant, who knows too little of melting to establish efficiency standards; or the manager, who is seldom in a position to decide which of the two points of view should prevail. In practice the training and sympathies of the manager are the ultimate factors in the policy adopted, if any, in regard to efficiency questions. The problem resolves itself into how to merge cost and technical controls so as to get an informed objective viewpoint and permit management to steer a true course for maximum efficiency of operation. Some thoughts on how this can be achieved are given below.

Conflict of Interests

On first consideration there appears to be little in common between the technical and cost points of view and, in fact, a conflict of interests appears to exist between them. The attitude towards material costs is an example of this. The cost accountant will want to see expense items held to a minimum. He is not concerned with the technical difficulties that may arise. His primary interest is to present to the management the true position in regard to costs of production, and to expose waste and inefficiency. However, he tends to regard expense items separately from the process of which they are a part, and to consider merely whether each item shows an increase or decrease, as compared with a previous period. He is often unaware of operating conditions, and frequently finds difficulty in obtaining or appreciating technical information on which to base the true value of the expense involved. Thus, the cost accountant is at a disadvantage in providing the management with an accurate picture of the state of operating efficiency.

The metallurgist is concerned principally with maintaining quality of production to a desired or specified standard. His main interest is to prevent a possible breakdown in control leading to loss of quality and rejection of output. From his point of view, a penny saved in the purchase price or consumption of materials may lead to the loss of pounds in defectives. He, therefore, tends to play safe by being liberal with such materials as coke, a little extra of which provides that margin of safety which keeps him out of trouble. This attitude is shared by the foundry in general in regard to other materials and expense items. It is perfectly natural and is typical of those processes which depend to a large extent upon the human element for their success, and where a large number of operating variables, not adequately controlled, exist.

The questions at issue between cost and technical controls are:—(1) How far it is possible to reconcile the reduction of operating costs with maintenance of quality; (2) the extent to which the standard of quality may be raised without increasing operating costs, and (3) whether an increase in operating costs may not be justified by a still greater increase in the sales value of the product.

Close Collaboration Essential

The closest collaboration between cost and technical departments is obviously essential to answer such questions, but this alone is not enough. Accurate data must be available on which evidence can be based, and there must be, in addition, the right treatment of these data to yield conclusive answers as to quality and costs.

Under present conditions, the responsibility for determining how far it is safe to go in reducing costs for materials or labour in the production of molten metal falls on the metallurgist. Similarly for moulding and coremaking operations, it is left to the foundry to decide the economic limit beyond which an immediate reduction in operating cost may be more than offset by a subsequent loss in the foundry or machine shop. Examples of disasters which have overtaken the foundry through seeking cheaper materials and methods without adequate control protection are many and varied, making the foundry wary in regard to cost reduction suggestions.

The first essential in any programme for increased efficiency is a complete and reliable record of past performance and experience. This is rarely available to anything like the extent necessary in attempting to forecast the effect of introducing changes in raw material or process. Before an intelligent attempt can be made to increase efficiency there must exist a basis of technical control which will permit assessing accurately the effect of altering one variable at a time, and a basis of cost control to provide data of costs and efficiency for variable conditions of materials and method. Only on these lines can the fears of the foundry and metallurgist in regard to cost reduction be overcome and the objects of cost control be made to harmonise with those of technical control.

Cost and Technical Controls in the Foundry

Technical Control

In the past, technical control, where it has existed at all, has functioned through a system of checks on a number of key operations. Each operation has been held to as narrow a limit of variation as possible so that the total process variation will be at a minimum. A breakdown in control on one of these key operations would affect the total process variation and probably result in a change in product quality. The difficulty has always been to relate operating conditions with product quality, and this is precisely where the old methods have been inadequate. For one thing, there has been no means of expressing process control *quantitatively*, and for another thing there was no way of telling the state of control at any given time and relating it with the product. Consequently, any attempt at increased efficiency through altering one or more of these key operations was risky, since it upset the balance between operating control and product quality without the safeguard of an evaluation of the change in quality. Correcting this condition must be the main consideration in any programme for increasing foundry efficiency.

The method by which this can be accomplished calls for a complete departure from the old trial and error methods. It involves control of product quality. This is the first step, and it is fundamental. Until a state of control has been obtained, nothing can be done with any degree of safety about altering operating variables. (State of control is used in the statistical sense, carrying a definite meaning.*) At this stage quantitative control standards are established for the various product characteristics. These standards are used as the basis of comparison for altered operating conditions subsequently introduced to increase efficiency.

Operating Variables

The next step is the correlation of operating variables to product quality. One of the earliest lessons taught by the statistical control chart was that operating variables could be related to the state of control, and it has been found possible to interpret movements and trends on the control chart in terms of operating factors. For example, change in melting-fuel consumption or grade of fuel can be related to metal characteristics and casting properties, including chemical and physical properties, temperature, fluidity, misrun defectives, shrinkage defectives, etc. Similarly for other operating factors. For example, metal charge compositon and quality of metal raw materials related to metal characteristics and casting properties; sand properties related to casting finish and defectives; pouring practice (rate of pour, pouring temperatures, etc.) related to casting defectives; moulding method related to casting defectives and output. The two essential conditions are that the product shall be in control in regard to the properties examined, and that control records shall be available giving reliable data for the operating factors being considered. In many cases this information is already available, but not effectively used.

*See "Quality Control in High Duty Iron Production," FOUNDRY TRADE JOURNAL, March 16, 23 and 30, 1944.

Co-ordination of Cost and Technical Controls

The third step is the translation of the above quality control relationships into cost and efficiency ratios. It is here that cost and technical controls must be co-ordinated. The technical man will be in a position to report the effect of a particular set of operating conditions on his control values, including not only metallurgical values, but also casting properties and defectives. The cost department can then relate the operating cost to the results obtained. It is not enough for the cost accountant to work out efficiency ratios and costs for the various operating factors and cost items. This gives only half the picture. They must be related to the practical results obtained in terms of metal quality, casting quality, casting losses, yield, etc.

Examples of some of the questions which can be correctly answered only on the above lines are:—(1) Is a foundry justified in changing to a more expensive grade of coke or other melting raw material?; (2) can coke ratios be reduced without loss of product quality?; (3) what is the most efficient melting rate for a given furnace and type of metal? (Efficiency here includes both cost and quality considerations.); (4) does a cheaper furnace lining material show an ultimate cost advantage when related to consumption and quality of product?; (5) has a change in type of moulding or core sand influenced casting quality and defectives?; (6) is there any advantage in using a different type of core binder, in terms of casting cost, finish and losses?; (7) what is the most efficient moulding method for a particular type of work, in regard to finish, output, losses, and ultimate cost?, and (8) is a lower yield figure justified by reduced defectives or increased casting sales value?

Whose Responsibility?

These and many other questions must be answered in the interests of efficiency. In how many foundries are they answered now? Whose business is it to answer them?

Neither technical nor cost controls alone can provide the answers. Together they can, provided there exists:—(*a*) A statistical basis for measuring product quality; (*b*) accurate data for past and present performance under specific operating conditions; and (*c*) correct treatment of available data to relate product quality to operating costs.

Whether a special department should co-ordinate the two controls, to promote more efficient working, must depend upon the type and size of organisation. But there can be no doubt as to the urgent need for greater efficiency in the present circumstances. Ultimately the responsibility lies with management, since it is the function of management to strive for greater efficiency and to set up an organisation capable of achieving that end.

THE GATING AND FEEDING OF STEEL CASTINGS*

Higher yield of sound castings results from application of science to gating problems

By S. T. JAZWINSKI, Dpl.-Ing. Met. (Member), E. D. WELLS, Assoc.Met. (Member) and S. L. FINCH (Member)

(*Continued from page* 252.)

Experimental Work

Development of the Most Economical Method of Gating and Feeding in Production.—The primary object of these experiments was to obtain the most efficient gating and feeding by means of the pencil core in a blind whirlgate head. To this end, the following series of experiments were carried out to determine the optimum mass of heads and size of neck which would feed a 4-in. cube.

(1) Heads of a standard diameter of 3 in. were used, varying the heights from 8 to 7, 6 and 5 in. Two sets were cast, one at 1,575 deg. C., one at 1,525 deg. C.

(2) Heads of a standard height of 8 in. were used, varying the diameters from 3 to 3½, 4 and 4½ in. Two sets were cast, one at 1,575 deg. C., one at 1,525 deg. C.

(3) Heads of a standard diameter of 3½ in. were used, varying the heights from 8 to 7 and 6 in. Two sets were cast, one at 1,575 deg. C., one at 1,525 deg. C.

(4) From 1, 2 and 3 the optimum mass of head was obtained which would feed a 4-in. cube. This mass was then given the smallest possible surface area which can be moulded under foundry conditions. (Note: It is not practicable to mould a sphere which would give the minimum surface area possible in theory.) Various heads were used with this surface formation to see whether surface area had an effect on feeding efficiency. Two sets were cast, one at 1,575 deg. C., one at 1,525 deg. C.

(5) From (4) the smallest mass with the smallest surface area that can be used in practice was determined. On this head, various necks were used to determine the minimum neck size that can be used. Two sets cast, one at 1,575 deg. C., and one at 1,525 deg. C. All the test-pieces were cast in metal, having an analysis range of carbon 0.10 to 0.15, manganese 0.60 to 0.90, silicon 0.35 to 0.45, phosphorus 0.03 to 0.06, and sulphur 0.02 to 0.04 per cent. All steel was prepared by the Tropenas converter process.

Optimum Head Size and Shape

(1) The first experiment was to standardise head diameters at 3 in., neck measurements at 3 in. by 2 in., and vary the head heights from 8 to 7, 6 and 5 in. Two sets of test-blocks were cast, one at 1,575 deg. C., the other at 1,525 deg. C. Both these sets were sectioned, and the results obtained are shown in Fig. 21. From these tests it was realised that the diameter would have to be increased if a sound casting was to be obtained.

(2) The diameters of a head, 8 in. in height, were increased from 3 to 3½, 4 and 4½ in. Two sets of test-pieces were cast, one at 1,575 deg. C., the other at 1,525 deg. C. The sectioned test-pieces and heads are shown in Fig. 22, and from this it can be seen that a head of 3½-in. dia. and 8 in. in height will feed the cube.

(3) The next experiment was to determine whether a reduction in height of the 3½-in. dia. head would affect the soundness of the cube. The head heights were reduced from 8 to 7 and 6 in. Two sets of tests were carried out, one cast at 1,575 deg. C., the other at 1,525 deg. C. The sectioned tests are shown in Fig. 23, and from these experiments it was realised that the mass of head necessary was 3½-in. dia. and 8 in. in height. The volume of this head and neck was 80 cub. in. and the surface area 95 sq. in.

(4) A further development in this series of experiments was to determine whether a reduction in surface area and consequently a reduction in rate of radiation would allow the use of a smaller mass of metal to feed the cube. The heads used had the dimensions shown in Table II.

TABLE II.—*Details of the Experimental Heads Used.*

Diameter, Ins.	Volume, Cub. Ins.	Surface Area, Sq. Ins.	Weight, Lb.	Neck, Ins.
5.5	109	86.0	31	3.5 × 2
5.0	82	69.0	23	3.5 × 2
4.5	60	56.0	17	3.5 × 2
4.0	42	44.0	12	3.5 × 2
3.5	28	34.0	18	3.5 × 2

Two sets of test-bars were cast, one at 1,575 deg. C., the other at 1,525 deg. C. The sectioned pieces are shown in Fig. 24, and it will be seen that the third head, 4.5-in. dia., feeds the cube successfully. This head has a mass of 60 cub. in., whereas the cylindrical type of head had a cubic capacity of 80 cub. in., but

* A Paper read at the 42nd annual meeting of the Institute of British Foundrymen, held in London, June 15 and 16, 1945. The Authors are respectively chief metallurgist, foundry superintendent and foundry methods engineer, K. & L. Steelfounders & Engineers, Limited, Letchworth.

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surface area of the "sphere" is only 56 sq. in. This where the surface area of the latter is 95 sq. in., the proves that the surface area of a head is an important factor if low yields are to be obtained.

Optimum Neck

Having obtained the optimum head size and shape, the next step was to establish the optimum neck size. The shape of the neck was to be rectangular, and as long as possible, so that it could be determined whether a sufficiently thin neck could be obtained so that the head could be knocked off instead of cut off. The neck sizes were reduced from 2 in. to 1¾ in., 1½ in., 1¼ in. to 1¼ in. All the lengths were standardised at 3½ in. Two sets of blocks were cast, one at 1,575 deg. C., the other at 1,525 deg. C., and the sectioned blocks are shown in Fig. 25.

The minimum neck that can be used with safety is the one with a depth of 1¾ in. and has a section area of 6.56 sq. in. The cross-sectional area of the head at the neck level is 16 sq. in., and the percentage of neck area is therefore approximately 40 per cent.

Before any further work was attempted, the principles obtained from these experiments were introduced into practice and various castings ranging from a few pounds to 5 cwts. were cast with successful results. The benefits from this system of gating and feeding can be clearly seen from Table III, wherein a comparison is made between gravity and the blind whirlgate head method of casting. Figs. 26 and 27 give a comparison between the two methods of casting. Table III is the summary of the new method that was successfully introduced into the foundry, and is representative of castings made over a period of time. The total time saved in man-hours and the saving in liquid steel per ton of castings produced is self-explained.

The Use of Graphite Rods

The upper portion of the iron-carbon equilibrium diagram may one day be applied to the process of feeding, and in this respect the Authors felt that it would be advantageous to include a note on experiments which were made to determine whether graphite rods improved the efficiency of a feeder head by lowering the liquidus.

Various sizes of rods were obtained and introduced in various ways in the feeder head. So that the data obtained could be compared with the previous experiments, the same test-block and heads were used as those which dealt only with atmospheric pressure. The standard head used was 3½-in. dia. and 6 in. high. Reference to Fig. 23 shows that, using a pencil core, this head was not quite large enough to feed a 4-in. cube and that a very small shrinkage cavity occurred in the cube.

Thus, if graphite rods improved the efficiency of feeding, it is safe to assume that a sound casting should be obtained with a slightly smaller head than that to be used when utilising atmospheric pressure only. The use of the graphite rod must prove to be economical, while at the same time there must be improved efficiency if this system is to be of practical value.

Three sizes of graphite rods were used, namely, ¼ in., $\frac{5}{16}$ in. and ⅜ in. dia., and, in addition, one set of experiments was completed using ½-in. carbon rods. These rods were introduced to the head horizontally and vertically at different depths in the blind

TABLE III.—*Comparative Data using Two Systems of Feeding.*

Casting.	Finished Weights, Lb.	Rough Weight, Lb.		Yield Per Cent.		Operations Times per Casting.						Total Wt. of Liquid Steel Saved Per Ton of Castings, Lb.	Time Saved per Ton of Castings, Mins.*				Total Time Saved Man-hrs.
						Cutting Off, Mins.		Grinding, Mins.		Fettle, Mins.							
		Atmospheric Head.	Gravity Head.	Atmospheric Head.	Gravity Head.	Atmospheric Head.	Gravity Head.	Atmospheric Head.	Gravity Head.	Atmospheric Head.	Gravity Head.		Liquid Steel.	Cutting Off.	Grinding.	Fettling.	All Operators.
1	12	20	30	60	40	3	5	5	7	10	35	1,867	336	372	372	4,650	95.5
2	64	89	120	72.3	53.2	4	3.5	3	6	20	25	875	157	17.5	105	175	7.0
3	98	140	196	70	50	4	45	5	30	20	80	1,277	230	935	479	342	33.0
4	119	185	248	65	48	12	17	12	20	30	45	1,184	214	99	150	182	10.5
5	276	396	501	70	55	15	30	10	30	40	65	840	150	121	162	222	11.0
6	361	544	722	70	50	9	30	12	12	45	90	1,068	191	130	0	279	10.0
7	472	598	786	78.7	60	1.5	6	3	6	60	75	884	160	20	14	72	4.75

*Allowing 6.75 man-hours per ton of liquid steel.

head. In these experiments, apart from the shape of the shrinkage cavity formed, it was of paramount importance to determine the segregation of carbon, especially in the neck portion of the head adjacent to the casting. This segregation would result in hard spots and thus scrap castings.

It is obvious, then, that even if efficient feeding be obtained using graphite rods, instead of the pencil core, if segregation was found to occur, the use of graphite rods would be impracticable. To obtain comparable results it was necessary to standardise the positions in the sectional heads from where drillings would be taken for carbon estimation. Fig. 28 shows the numbered positions in a sample of a sectioned head, and in Table V all the numbered positions for each head correspond with these standard positions. All the test-pieces were cast at approximately 1,550 deg. C. in metal, having the following compositions: C, 0.10; Si, 0.45; Mn, 0.70; S, 0.030; and P, 0.045 per cent. All moulds were made from the same sand and all conditions were standardised with the exception of the size and position of the graphite rods. From Table IV it can be seen that the general trend of segregation increases when:—(1) The thickness of the graphite rods is increased; (2) the depth of the graphite rod is increased; and (3) the position of the graphite rod is vertical.

In the Authors' opinion, even if segregation be not dangerous, *i.e.*, in positions 1, 2, 3, 4 and 5, see Fig. 28 (as is not the case), and does not place the steel outside chemical specifications, the application of graphite or carbon rods does not appear to give any special advantage, as the yield is not increased when compared with exactly the same heads and castings using the atmospheric whirlgate head.

Figs. 29 and 30 illustrate the sectioned heads which were obtained when using graphite and carbon rods, each number corresponding to the sample number in Table IV.

Discussion of Results

(1) It was found that a head of 3.5-in. dia. head, 8 in. high, would successfully feed a 4-in. cube. Any reduction in diameter or height (keeping one of the dimensions constant) resulted in a shrinkage cavity in the cube.

(2) When the surface area of the head in (1) is reduced to a minimum in order to reduce radiation losses, a more spherical head will result in a further saving of 30 per cent. head metal.

(3) The development of optimum neck size was made using the test cube of 4 in. One object of this was to determine whether a head could be knocked off instead of cut off. The minimum neck was 1¼ in. thick, and its sectional area was equivalent of 40 per cent. the thickest sectional area of the head. This proportion results in heads which cannot be knocked off and require removal in some other manner.

TABLE IV.—*Segregation Due to Use of Graphite Rod System.*

Sample No.	Dia. of Graphite Rod in Ins.	Depth in Ins.	Position.	Carbon Content in Per Cent. Numbered Positions. 1	2	3	4	5	6	7	8	9	10	11	Remarks.
1	½	1	horizontal	0.09	0.08	0.10	0.10	0.13	0.11		0.11	0.11		0.14	
2		2			0.11			0.16				0.14		0.33	
3		3			0.13	0.13	0.24	0.64				0.17			
4		1	vertical		0.11	0.12	0.12	0.13			0.12	0.13			
5		2			0.13	0.12	0.11	0.21							
6		3			0.18	0.11		0.20						0.21	
7	⅝	1	horizontal	0.11		0.14		0.24							
8		2		0.10		0.13		0.11						0.70	Casting sound.
9		1	vertical	0.12		0.13		0.14							
10		2		0.12		0.13		0.15							
11	¾	1	horizontal	0.12		0.14		0.17				0.14			
12		2		0.12		0.14						0.13		0.13	Casting sound.
13		1	vertical	0.12		0.12		0.13				0.12			
14		2		0.13		0.55		0.52							Casting sound.
	Carbon Rod.														
15	½	1	horizontal	0.12		0.12									
16		2		0.11		0.14									
17		1	vertical	0.13		0.12									
18		2		0.11		0.15									

All castings produced, with the exception of the three shown, were unsound.

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(4) The principles obtained from the experimental work were introduced into the foundry, and a variety of castings (approximately 200 types with batch production off each) were produced giving much better yields with atmospheric whirlgate heads than gravity heads. Yields of 65 to 78 per cent. were obtained using this method, resulting in a great saving in liquid steel and man-hours in the fettling shop, whilst still producing good-quality castings.

(5) The application of graphite and carbon rods was investigated using various sizes of rods in different positions in the feeder head. The segregation of carbon and the feeding efficiency were determined and from the results obtained it can be said that at the present time graphite or carbon rods are not an economical proposition.

Conclusions

(1) The aspects of feeding and gating in relation to ferrostatic, atmospheric and centrifugal pressure are described. Providing that certain fundamental laws are obeyed, each will function efficiently.

(2) The system of feeding depends not only on the disposition of the feeder heads and the applied pressure, but on the maintenance of a balanced system of feeding, using any combination of heads.

(3) It is necessary in gating to promote directional solidification. In addition, the effect and occurrence of convection currents must be borne in mind.

(4) Many factors influence the speed of metal supply to a casting, and these should be standardised as much as possible, as this is an important point when gating a mould.

(5) Although shrinkage is usually corrected by systematic feeding, efficient gating often tends to minimise the danger of this defect.

(6) The four main systems of gating and feeding applied to castings have been described (orthodox, whirlgate, atmospheric whirlgate, and centrifugal), and it can be seen that each one depends on the design of the casting, and, if used in conjunction with the known fundamental laws of feeding and gating, will be successful, although the yields will vary from gravity (lowest) to open-type whirlgate, atmospheric whirlgate to centrifugal (highest).

(7) The solidification of a feeder head affects the supply of metal to the casting, as will be seen from the description given in the early part of the Paper.

Acknowledgments

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LIGHT METALS INDUSTRY

WARTIME ACHIEVEMENTS

An idea of British achievement during the war in producing and fabricating light-metal alloys may be gained from a statement on the subject issued by the Ministry of Aircraft Production. Many of the totals are virtually astronomical and difficult even for the technician to appreciate at their true value. At the height of the war effort the extrusion branch of the industry was producing 9 million light alloy tubes every month and 400 million light-alloy rivets every week—representing approximately 660,000 rivets a second over a 24-hr. working day. In the castings branch of the industry the totals are also impressive. Not only was an increasing number of castings required, but, simultaneously, a very much higher proportion of the large intricate castings in high-strength heat-treated alloys. Castings for aero engines rose from approximately 600 tons a month at the middle of 1940 to 2,500 tons a month in early 1944. Output of cylinder heads for air-cooled aero engines reached a peak of 2,000 heads a day. Production of electrical plugs and sockets for aircraft was increased from 425,000 castings a month at the beginning of 1942, to 3,000,000 in just 12 months.

Magnesium Castings

Mágnesium castings for wheels reached a peak of 1,000 a day, while the size and intricacy increased progressively during the war period, culminating in the production of the landing wheel for the Lincoln aircraft weighing 336 lbs. This is the heaviest single casting produced in either magnesium or aluminium. Enormous technical progress was made with the production of large gravity die-castings, with resultant improved properties, accuracy, and greatly increased output for a given labour force and factory space. Production of magnesium bodies for the 4-lb. incendiary bomb increased from 20,000 a month in early 1941 to 4,660,000 at the beginning of 1944. Over 98,000,000 were produced between 1941 and 1945.

The total number of general stampings produced was increased from 1,750,000 a month at the beginning of 1940 to approximately 4,500,000 a month at the beginning of 1944. Output of cylinder barrel forgings for air-cooled radial engines rose to well over 1,100 barrels a day by early 1944. Output of propeller blade forgings reached 15,300 a month.

MAJOR VICTOR LEDWIDGE, on his release from the R.F.A., has been appointed to the staff of London Metal Warehouses, Limited.

TIN PRODUCTION IN THE FAR EAST

PROBLEMS OF RECONSTRUCTION AND REHABILITATION

The United States anticipate receiving less pig-tin in 1946 than in 1945 from present sources. Part of the output of the Belgian Congo will be diverted to fill the needs of the liberated areas and neutral countries; no more will arrive from Portugal because of the end of preclusive purchasing in that country; the small receipts from China will cease and be diverted to consuming countries in that part of the world. There has been discovered about 1,000 tons of pig-tin formerly in German hands which America hopes to receive before the end of the year. Arrangements have been made to secure from Britain 4,000 tons of pig-tin, and if this arrives before the end of the current year 1945 imports of pig-tin by the United States will approach those of 1944. Any tin found in the Far East will probably not arrive until some time next year.

A report by the U.S. War Production Board states that receipts of tin concentrates during 1946 will probably be less than during 1945. This will be due to an anticipated lower output from Bolivia. A large tonnage of concentrates from the Belgian Congo may be converted into pig-tin at the Union Minière du Haut Katanga tin smelter in Hoboken, Belgium, and sold to European consumers. The small tonnage of concentrates from the French Cameroons and the concentrates and slags from Mexico may go to European smelters. The Belgian and Dutch tin smelters have suffered only small damage and should be ready for operation in a matter of months.

News Awaited

The end of the fighting in the Far East has altered the picture for 1946. So far little authoritative news has been received regarding tin supplies in that area. If conditions are found to be better than was anticipated it is possible that America may receive, as her share of the total available pig-tin or tin in concentrates found on hand or produced in the next year or so, a sufficient tonnage to offset the drop in receipts from present sources of supply, or even to increase the total new supply.

The United States has never been able to develop a domestic tin-mining industry, notwithstanding the expenditure of considerable sums of money. The Geological Survey, the Bureau of Mines and other agencies have carefully examined all potential mines with no success. The likelihood of the United States ever being a substantial tin-producing country appears remote.

Since the mine production of tin in the United States is almost non-existent, domestic new supply consists chiefly of secondary pig-tin recovered from tin-plate scrap and used cans, plus a large quantity of tin recovered from old tin-lead and copper-base alloy scrap.

During 1944, consumption of tin was approximately 9,000 tons greater than in 1943 and even exceeded the consumption of tin in 1942. For the first six months of 1945, consumption has been running at an even greater rate.

Search for Stocks

The United States military forces in the Far East have been requested to conduct a thorough search for stocks of pig-tin in China, Japan and other areas from which tin might be available to the United States. Although there have been numerous rumours about large stocks of pig-tin being available at the Penang and Singapore smelters and at other points, no verification of these rumours has been received. The Japanese smelters must have had an ample supply of concentrates from Thailand, where the tin properties were reported to have been seized intact, together with the produce tin from manual operations in Malaya and the Netherlands East Indies. Perhaps some of the concentrates from the latter areas were smelted locally, as the two principal smelters in the Federated Malay States have been reported found in good condition. Japanese production was in excess of her needs, as she was able to supply Germany and other countries with pig-tin.

Every effort will be made to rehabilitate properties in Malaya, Burma, Thailand and the Netherlands Indies. The British and the Dutch both sent missions to their respective tin-producing areas to appraise the damage and ascertain what steps can be taken to put the properties into operation at the earliest possible moment.

During the first year of re-occupation there will be some output of tin concentrates derived from manually-operated, Chinese-owned mines in Malaya and from the manually-operated, Dutch-controlled mines in the Netherlands East Indies. How much will depend upon the availability of the Chinese labour force. If the hundred-odd thousand labourers formerly employed are widely dispersed it will take some time to reassemble them. Those properties partly mechanised will probably require electrical repair parts, motors, Diesels and pumps.

The last stage will be the re-entry of the dredging enterprises into production. This phase will take a considerable period, as many of the dredgers are known to have been damaged. From reports that have filtered through it appears that the Japanese have dismantled the super-structures of these damaged dredgers and shipped the scrap back to Japan and used the electrical equipment elsewhere. If this proves to be true, then a considerable period of time must elapse before dredging output becomes a factor in the total output.

Dutch East Indies

Production from dredges may rise very slowly, and it may take many years before it reaches pre-war figures, especially in Malaya. In fact, the output may never again reach that level. The problem is quite different in the Netherlands East Indies from that of Malaya for several reasons.

In the Netherlands East Indies, there are only two

Tin Production in the Far East

organisations producing tin—the Banka properties, which are run by the Government, and the Billiton properties, in which the Government has a five-eighths interest. Consequently, new equipment can be ordered immediately by the Government or by Billiton with the backing of the Government. In the case of dredges, they can be built in Europe or the United States and floated to the scene of operations, which are the submarine deposits along the coast of the Banka, Billiton and Sinkep Islands.

In Malaya, there were more than 1,000 tin-mining operations in 1937, the year of peak production. There were hundreds of companies operating these properties. Approximately 120 dredgers, owned by perhaps 75 companies, were in operation before the Japanese occupation. Operations for the most part were profitable, but the companies distributed their earnings in dividends and rarely retained more than a small amount in their treasuries. With their dredgers damaged or ruined, they do not possess the money required to rehabilitate or to purchase new dredgers, the report states. Unless the Government steps in and buys equipment and lends or leases to those companies, a considerable period may elapse before the properties are re-equipped.

Exhausted Fields

Many of these companies, even after they receive compensation, will never again purchase a dredger, because the acreage of their holdings which remain undredged will not be large enough to amortise the investment in the dredge before the property is exhausted. They may hold the property for a time to await developments; they may turn it over to tributors to work as the tributors see fit; or, if they are fortunate in being contiguous to another property in similar position, they may either sell the ground, lease it or amalgamate with the adjoining company and thus have sufficient acreage to amortise the cost of a new dredge. Another possibility is the use of dredges which have portable pontoon-type hulls and superstructures which are more readily and cheaply dismantled and moved than the existing designs. Multiple dredging operations on large tracts will probably replace their lost equipment with fewer dredgers than they had before the war for similar economic reasons. In any case, it will result in a much slower rehabilitation and perhaps a permanently lower output.

Because most Malayan tin mines are inland from the coast, it is the practice to erect these dredgers on the operating sites. This means that for a given type there will be a greater time-lag between ordering and putting into operation, than with tin deposits directly accessible by boat.

Not quite half of the tin concentrates produced in Malaya came from dredging enterprises. Approximately one-third came from gravel-pumping operations and the balance, which was about one-fifth, came from hydraulic working, Dulang washers (hand-operated panning) and underground lode mines. European-owned mines produced about 70 per cent. of the tin, while Chinese-owned operations accounted for the balance. Approximately 80,000 natives were required to produce the tin concentrates.

In the Netherlands East Indies, Banka accounts for about 60 per cent. of the output and Billiton about 30 per cent., while Sinkep and others produce the balance. The Sinkep enterprise is controlled by Billiton.

The Banka mines, which are among the world's lowest-cost tin producers, comprise more than a dozen dredgers and over 40 open pits, although several hundred mines are operated from time to time. Employment of natives has exceeded 22,000, but mechanisation during the 1930's reduced their need to around 15,000. Billiton and Sinkep have also been increasingly mechanised in recent years.

Burma and Thailand

Burmese tin output is small and derived from half-a-dozen dredging enterprises and a few lode-mining companies which produce mixed tin and tungsten concentrates. Their predicaments will be similar to the Malayan producers insofar as they are individual company operations.

Thailand is a substantial producer of tin concentrates, which are derived almost entirely from dredging operations of British- and Australian-owned enterprises. Most of the production was reported to have been taken over without damage to equipment, and the Japanese are supposed to have placed reliance upon this source for tin.

The tin mines of French Indo-China are of little importance. Here, half-a-dozen companies produce approximately 1,500 tons of tin in concentrates or pig-tin per year.

Japan produces on the order of 2,000 tons of tin in concentrates or as metal per year. It has smelting capacity in excess of this, but, except for the operations of its trading companies such at Mitsui, Mitusbishi and others, it is not an appreciable factor in the world tin industry.

China, itself, is a fairly large producer of pig-tin; the concentrates are smelted entirely within the country. In the past, China shipped some tin to America, and during the war the United States received occasional shipments. The U.S.S.R. also received substantial amounts from this source. The Japanese are believed to have captured considerable tonnages of pig-tin in their advance into the producing areas. A small tonnage of pig-tin, reported to be 900 tons, has been recovered by the Chinese, according to a cable just received, but whether any other substantial amounts will be recovered is problematical. Although the country possesses the capacity to produce about 15,000 tons of pig-tin per year, the terrific inflation in China almost wiped out production. Until adequate food and other supplies are obtainable at reasonable cost, it is not probable that China will be able to produce very much tin, and the mines captured by the Japanese may require extensive rehabilitation.

JUVENILE EMPLOYMENT SERVICE

COMMITTEE'S REPORT

The report of the Committee on the Juvenile Employment Service under the chairmanship of Sir Godfrey Ince, which was set up last January by Mr. Ernest Bevin when Minister of Labour and National Service, has now been published. Below are given extracts from the report.

Technique of Vocational Guidance.—Vocational guidance, it is suggested, should be given in two stages. In the course of their last year at school, all school-leavers should attend a talk in which the different kinds of career open to them should be described in general terms. This should be given by an officer of the Service, preferably at school, in co-operation with the school teachers, and parents should be invited to be present. The second and more important stage is the school interview. This should be an intimate talk in which the object should be to win the complete confidence of the juvenile and to advise him about employment suitable to his aptitudes. For this reason, apart from the teacher and the parent, no other adult should normally be present.

Careers Pamphlets.—The committee recommends that full information about careers should be made available to parents and juveniles and that the Ministry of Labour should prepare a series of suitable pamphlets.

Placing.—The second function of the Juvenile Employment Service is the placing of the juvenile in employment. After full consideration, the committee does not recommend the institution of any system of compulsory control of engagements. Juveniles would accordingly be free to choose their jobs, but the committee is confident that, in view of the vocational guidance which they will already have received, the Juvenile Employment Service will be more widely used and become, in consequence, more effective.

Industrial Supervision.—The third function of the Service is supervision. The committee regards it of the highest importance that the Juvenile Employment Officer should keep in touch with juveniles after they have entered employment. The aim should be to make the young worker feel that in the Juvenile Officer he has a friend to whom he can bring his difficulties and worries. The committee recommends a number of avenues of approach and emphasises that the Service should keep in touch with employers, trade unions and the various clubs to which juveniles belong.

Transference for Training.—The committee recommends that a scheme of training grants should be instituted to enable suitable boys and girls to take a course of training for a skilled occupation away from home where no suitable facilities are available within daily travelling distance of their homes.

Advisory Bodies

The committee attaches great importance to the help which the Juvenile Employment Service can derive from advisory bodies composed of representatives of education, industry and other persons interested in the welfare of juveniles. It accordingly recommends that the Central Executive should be assisted by a National Advisory Council for Great Britain, with separate advisory committees for Scotland and Wales under chairmen selected by the Ministry of Labour. Their functions should be to consider all matters affecting the Service and to make recommendations designed to promote its efficiency.

In the local areas, the committee recommends that the present Local Advisory Committees should continue under the common title of Juvenile Employment Committees, and that care should be taken to ensure that their membership is properly representative of educational, industrial and other relevant interests.

BOOK REVIEWS

"A Dictionary of Metallurgy." By R. T. Rolfe. Published by Chapman & Hall, Limited, 37, Essex Street, London, W.C.2. Price 15s. net.

The author has certainly done the more scientific side of metallurgy a real service in compiling this book. It will be of great value to anyone entrusted with the task of translating metallurgical material into a foreign language. On the "trade" side, the book is not too good, and one misses definitions of such items as print, drawback, wear, terneplates, iron and steel, lumps, bond, boil, parting powder, hematite, blind riser, and so forth.

The reviewer queries the spelling of the word "dozzler"; at least, when he was a young man, the word rhymed with nozzle. The word "semi-steel" should not have been included for the very reason given by the author—it is obsolete. The definition of "shot blasting" requires amending to include "or mechanical propulsion." By the way, the next edition will require the addition of the term "Hydro-blast," as the word is not now capable of auto-definition. Though not strictly a metallurgical term, pH value might also be included.

The reviewer has perhaps stressed incompleteness too strongly, yet he is conscious and appreciative of the vast field which has been covered, and congratulates the author on the thoroughness of his work.

V. C. F.

"Transactions of the Manchester Association of Engineers—Session 1944-45." Edited by John Bolton, assistant secretary, and published by the Association from St. John Street Chambers, Deansgate, Manchester, 3.

There are eight Papers printed in this year's Transactions, none of which has any direct bearing on foundry practice, except perhaps Mr. Timms' study of surface finish measurement. All the Papers, however, cover subjects which foundrymen could usefully study. The discussion on Prof. H. Wright Baker's Paper on technical education brought into relief the importance which the Lancashire engineer still attaches to the practical aspect. Surely a *balanced* training is the end to be sought. A little more theory for the naturally practical Lancastrian and a little more practical work for the mathematically minded Continental would make for a better industrial set-up.

V. C. F.

FORTHCOMING EVENTS

(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)

NOVEMBER 30.

Institute of Welding (East Scotland branch):—"Design of Building and M/C Structures," by M. Riley. At the Heriot Watt College, Chambers Street, Edinburgh, at 7.30 p.m.

Keighley Association of Engineers:—Members' discussion night. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

Institution of Mechanical Engineers:—Discussion on "Pistons and Piston Rings," centring on short Papers introduced by J. S. Courtney-Pratt, G. J. Tudor, and Dr. B. Pugh. At Storey's Gate, St. James's Park, London, S.W.1, at 5.30 p.m.

Manchester Association of Engineers:—"Metallic Materials Inspection, with Particular Reference to Non-destructive Testing Methods," by J. E. Garside. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

DECEMBER 4.

British Society for International Bibliography:—"Plastics: Their Nomenclature and Classification," by Dr. R. T. W. Reynolds and W. A. Silvester, and "The Information Bureau of the Electrical Research Association," by A. E. Tooke. At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, at 2.30 p.m.

Institute of Welding (N.E. Tyneside branch):—"Metallurgy of Aircraft Welding," by R. Smallman-Tew. At the Mining Institute, Neville Hall, Newcastle-upon-Tyne, at 6.15 p.m.

Iron and Steel Institute:—Joint meeting with the Sheffield Metallurgical Association. "Mould and Core Paints and Washes, and Parting Powders," by Dr. W. J. Rees. At Sheffield Metallurgical Club, 198, West Street, Sheffield, 1, at 7 p.m.

DECEMBER 5.

Institute of Welding (Leeds branch):—"Some Advantages and Dangers of Welding with High Amperages and Heavy Deposits," by J. M. Polson. At the Technical College, Huddersfield, at 7 p.m.

Institute of Welding (West Scotland branch):—Joint meeting with the Institution of Structural Engineers. "Mulberry Harbour: A Note of Some Technical Problems in the Construction of the Pierheads," by R. A. McDonald and D. W. Low. At the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent, Glasgow, C.2, at 6.30 p.m.

DECEMBER 6.

Chemical Engineering Group:—Joint meeting with the Bristol section of the Society of Chemical Industry and the Institution of Chemical Engineers. First Robert Horne Memorial Lecture on "Chemistry, Metallurgy and Empire," by Stanley Robson. At the University Chemical Department, Woodland Road, Bristol, at 5.30 p.m.

Institute of Welding (N.E. Tees-side branch):—"Welding of Plastics," by Dr. J. H. Paterson. At the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.15 p.m.

Institute of Welding (Portsmouth branch):—"Some Aspects of American Welding," by Dr. I. G. Slater. At the Gas Company Offices, Guildhall Square, Portsmouth, at 7 p.m.

DECEMBER 7.

Institute of Welding (South London branch):—"Welding of Plastics," by Dr. Hain and Dr. Zade. At Borough Polytechnic, Borough Road, London, S.E.1, at 7.30 p.m.

DECEMBER 14.

Staffordshire Iron and Steel Institute:—Open discussion: "How Far Can Iron Castings Replace Steel?" At the Dudley and Staffordshire Technical College, The Broadway, Dudley, at 7 p.m.

DECEMBER 15.

Manchester Association of Engineers:—Conversazione and dance. At the College of Technology, Manchester.

Institute of British Foundrymen

DECEMBER 1.

Lancashire branch:—"Secondary Aluminium Casting Alloys in War and Peace," by F. Smith. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

DECEMBER 8.

West Riding of Yorkshire branch:—"Training Problems in the Foundry," by G. W. Green. At the Technical College, Bradford, at 6.30 p.m.

DECEMBER 15.

East Midlands branch:—"Some Principals of Production Control and Their Application to the Manufacture of Steel Castings," by A. B. Lloyd. At Loughborough College, at 6 p.m.

CORRESPONDENCE

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

Cleaner Pig-iron Wanted

To the Editor of THE FOUNDRY TRADE JOURNAL.

SIR,—Various articles which have appeared in the JOURNAL on improved control of melting in cupolas have proved conclusively that, if a cupola receives fair treatment and is operated under controlled conditions, better results are obtained. The use of clean scrap of a size and thickness suitable for a particular cupola and required quality of metal has been found to be worth the trouble. Moreover, many foundries which previously made rough gutters on the sand floor for receiving their surplus metal are now using iron moulds for this purpose. Thus, the metal returned to the furnace is clean and of standard size.

These advances are at the moment being offset by the fact that many consignments of pig-iron are very rough, carrying on their surface large quantities of sand, are of irregular shape and size and include sows up to 5 ft. in length. It would appear that the iron-founder, after many years, appreciates the benefits of cleaner melting and that it is now the time for the ironmasters to provide clean and regular-sized iron for the foundries. Fortunately, there appears to be a movement on the part of the blast furnaces to help founders in this respect.—Yours, etc.,

"CUPOLA ENGINEER."

USES FOR MAGNESIUM

Mr. T. W. Atkins, executive vice-president of the American Magnesium Association, in an article he contributed to "Modern Metals," suggested the following uses for magnesium:—Horse shoes; (leather covered) saddles (jockey, western and McCleland), stirrups and magnesium sulkies; hotel room keys; bracelets, and everything that goes in the ladies' handbag; nose rings for the beauties of Bali-Bali; butcher knife handles; sledges; paint boxes for carrying the equipment of window decorating artists; cow bells; tea carts; spikes for running shoes; cleats for baseball shoes; vaulting poles; water buckets; milk pails; revolving doors; lighter cases; hearing aid kits; batons; toboggans; walking sticks; cocktail shakers; kitchen cannister sets; bread boxes; egg beaters; surf boards; tripods; and ski poles.

BELGIAN IRON AND STEEL INDUSTRY

MORE BLAST FURNACES TO START

A further resumption of operations in the Belgian iron and steel industry is now certain in the near future. Sambre-et-Moselle will blow in two blast furnaces for the production of basic pig-iron in January next; there will then be 10 Belgian plants with furnaces in active production; three in the Liège region (Espérance-Longdoz, Cockerill, Ougrée), five in the Charleroi basin (Providence, Thy-le-Chateau, A.M.S., Hainaut, and Sambre-et-Moselle), one in the Centre (Boël), and one in Brabant (Clabecq). Production of basic pig commenced at Hainaut on November 10, and two blooming mills were put into operation there some days later.

Coke Supplies

The quota of coke earmarked for the iron and steel industry for November is between 80,000 and 85,000 tons; no alteration was made in the quota initially fixed for October, but some supplementary allocations were made to firms possessing no stocks of coke. Arrivals of ore continue to be satisfactory; the Briey basin is now providing about 150,000 tons a month.

Export inquiries have been on a large scale, notably from the Argentine, Egypt, and the Near East.

Replying to a debate in the Chamber on the iron and steel industry, M. de Smaele, Minister of Economic Affairs, stated that production of iron and steel had amounted to 9,500 tons a month during the first quarter of the year, 39,000 tons a month during the second quarter, and 65,000 tons a month during the third quarter, thus expanding more rapidly than some other branches of industry. Many more blast furnaces had been relighted in Luxemburg than in Belgium, but output of pig-iron had remained lower. Every effort was being made to increase the quotas of coal allotted to coke ovens, so as to secure more gas for domestic use and more coke for the iron and steel industry. Since February, the quotas had been tripled, while coal production had only been doubled. This policy was being continued.

Price Levels

Replying to suggestions that the price of iron and steel had been fixed too low, the Minister replied that prices were fixed on the basis of the cost of ore and the wage levels. The only reason why British iron and steel prices were higher than those in Belgium was that wages in Great Britain were higher. The sole reason for the losses sustained by Belgian iron and steel producers was under-production, and these losses would soon be a thing of the past.

The annual report of the S.A. Métallurgique d'Espérance-Longdoz states that the Liège works were severely damaged by flying bombs. Activities were resumed in October, 1944, but output was severely restricted by lack of raw materials, and shortage of coal and ore caused the closing down of blast furnaces and steelworks in December. From that date to the end of the financial year (June 30), the works only received sufficient coal to operate one oven.

DEATH OF MR. JAMES HENDERSON

Mr. James Henderson, a director of the United Steel Companies, Limited, died at Leatherhead on November 20, after an operation. He was 77. Mr. Henderson was one of the best-known figures in the iron and steel industry, being closely associated with many branches of its technical activities. His work at the Appleby-Frodingham Steel Company, Limited, of which he was managing director and deputy chairman until he retired in 1934, will long be remembered. For many years he was honorary treasurer of the Iron and Steel Institute, of which he became president in 1942 for a two-year term. In recognition of his services to the industry he was awarded the Bessemer gold medal of the Iron and Steel Institute in 1939, and last year was made an honorary member. The last honour accorded him occurred only a few months ago, when his portrait, by Oswald Birley, was presented to the Institute by the board of the United Steel Companies, Limited, in recognition of his lifelong service to the industry.

Mr. Henderson was the last president of the National Federation of Iron and Steel Manufacturers (1934-35), and was largely responsible for the reorganisation which brought into being the British Iron and Steel Federation. His reputation was international and he was honoured by various metallurgical associations abroad.

MORE WAR FACTORIES RELEASED

Sixteen more Government factories have been allocated for civilian production by the Board of Trade. They represent an area of nearly 2,000,000 sq. ft., and will employ over 7,000 people. Up to date, 132 Government factories with an area of about 37,000,000 sq. ft., and estimated to provide work for about 270,000 people, have been allocated by the Board of Trade for civilian industry or as disposals depots. Among the 16 factories now allocated are:—

Wortley: Hayes Engineering Company, Limited, machine tools.

Leeds: Thos. Green & Sons, Limited, road rollers.

Thornliebank, Glasgow, Mond Nickel Company, Limited, processing of nickel-containing materials.

THE BOARD OF DIRECTORS of Edgar Allen & Company, Limited, Sheffield, announce the establishing of a scholarship, to be known as the Charles Kingston Everitt Memorial Scholarship, tenable at a University or other appropriate educational institution. The scholarship, which will have the annual value of approximately £200 per annum, is confined to employees of Edgar Allen & Company, Limited, or subsidiary companies. The first scholarship will be awarded in the autumn of 1946, to the employee who, in the opinion of the Works Education Committee, has shown the best progress at his work and part-time studies, and who is able to take full advantage of a University course or a course of study at some other suitable institution. The scholarship is in memory of Mr. C. K. Everitt, late chairman of Edgar Allen & Company, Limited.

PERSONAL

BRIG. A. B. CLOUGH has joined the board of Mason & Barry, Limited.

DR. HERMAN SHAW has been appointed director and secretary of the Science Museum in succession to COL. E. L. B. MACKINTOSH, who is retiring.

MR. A. M. SIMMERS has been appointed secretary of Arthur Lee & Sons, Limited, in succession to MR. JOHN MENZIES, who retains his seat on the board.

WING-COMMANDER J. H. GLADSTONE has rejoined the board of W. H. Dorman & Company, Limited, from which he resigned in December, 1939, to take up Service duties in the R.A.F.

MR. JOHN G. FEATHERSTONE has been appointed a director of the Fairfield Shipbuilding & Engineering Company, Limited, Govan, Glasgow. He will continue to act as secretary.

MR. VICTOR WATLINGTON, director of the British Electrical and Allied Manufacturers' Association, is to retire next year, when he will have completed 50 years' service in the electrical industry.

MR. G. ATKINSON, joint managing director of Cox & Danks, Limited, celebrated his 25th year with the company on November 15. The occasion was marked by a dinner given by his co-directors.

SIR JAMES FRENCH has been appointed chairman of the governors of the Royal Technical College, Glasgow, in succession to DR. ROBERT ROBERTSON, who has retired for health reasons. Sir James was vice-chairman and has been a governor since 1935.

MR. GEORGE WEST BYNG, executive director of Dorman, Long & Company, Limited, Middlesbrough, has been elected chairman of the Tees Conservancy Commission in succession to SIR WILLIAM CROSTHWAITE. Mr. Byng represents the Ministry of War Transport on the Commission.

SIR JOHN ANDERSON has been elected a director of Vickers, Limited. Other new directors of the company are SIR CLIFFORD FIGG, SIR THOMAS MERTON, and LT.-GENERAL SIR RONALD WEEKS. Sir John Anderson is rejoining the board, from which he resigned in November, 1938, upon his appointment as Lord Privy Seal.

MR. J. H. N. THOMPSON has been elected to the board of directors of John Thompson Engineering Company, Limited, Ettingshall, Wolverhampton. He is the eldest son of Colonel S. J. Thompson, of Stanley Hall, Bridgnorth, and was in France in the present war during the evacuation of Dunkirk. He held the rank of major for the greater part of the war and was awarded the M.C.

MR. NOEL KER LINDSAY, who has recently been appointed Director of the British Non-Ferrous Metals Federation, is an Edinburgh man. Born on Christmas Day, 1904, he took his B.A. degree at Oxford in 1926 and B.C.L. in 1927. He was called to the Bar as a member of Gray's Inn in 1927 and practised as a barrister in London and on the Western Circuit from 1927 until he joined the Army in 1940. He has a wide experience of commercial and industrial law. From 1931 to 1935 he was National Conservative M.P. for South Bristol; he was a member of the Departmental Committee on Housing, 1932, and the Estimates Committee, House of Commons, from 1933 to 1935. In 1934 he was chosen to move the Address in reply to the Speech from the Throne, and in 1935 was Parliamentary Private Secretary at the Ministry of Labour.

MR. J. H. PATCHETT, general works manager of the Acklam/Britannia Works of Dorman, Long & Company, Limited, has been elected president of the Cleveland Institution of Engineers for the 1945-46 session, in succession to Mr. Leslie Wright. Mr. Patchett, who joined Dorman, Long & Company in 1919, has held various managerial appointments with the company, specialising on blast-furnace operation until 1931 and subsequently extending his activities to other departments of iron and steel manufacture. He has been in control of the Acklam and Britannia iron and steel works group since 1938. A member of the Iron-making Panel of the recently formed British Iron and Steel Research Association, Mr. Patchett's selection as president by the Council of the Cleveland Institution is a recognition of his contribution to the development of the industry on Tees-side.

OCTOBER PIG-IRON AND STEEL INGOT PRODUCTION

The figures below show pig-iron and steel production in 1945, up to and including October.

	Pig-iron.		Steel ingots and castings.	
	Weekly average.	Annual rate.	Weekly average.	Annual rate.
	Tons.	Tons.	Tons.	Tons.
First half, 1945 ..	133,900	6,963,000	231,600	12,043,000
July	134,800	7,010,000	213,800	11,118,000
August	125,200	6,512,000	186,100	9,676,000
September ..	139,500	7,255,000	240,700	12,517,000
October	146,100	7,598,000	243,100	12,640,000

SINCE 1939 ALL GOODS imported into the United Kingdom from certain neutral countries have had to be accompanied by certificates signed by a British Consular Officer to the effect that no enemy had any interest in such goods, and that not more than 5 per cent. of their cost was due to enemy labour or raw material. The object of this provision was to prevent any substantial benefit from accruing to the enemy *via* neutral countries. This is now considered no longer necessary, and the Board of Trade have therefore issued the Import (Certificates of Origin and Interest) (Revocation) Order, 1945. The revocation means that importers need no longer produce certificates of origin in respect of goods imported from Liberia, Liechenstein, Portugal, Spain, Sweden and Switzerland.

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DALE Refined PIG IRON
The High-Quality Iron for High-Duty Castings.
Made in seven standard grades or to individual requirements, this iron has a close grain structure and fine graphitic carbon content. It replaces Hematite, and tones up high phosphorus irons.
We also make Dale Refined Malleable Iron to any required specification.
THE STANTON IRONWORKS COMPANY LIMITED
NEAR NOTTINGHAM

NEWS IN BRIEF

THE ASSETS, BUSINESS, AND GOODWILL of Kitson & Company, of Leeds, have been acquired by J. & H. McLaren, Limited, of Leeds, a subsidiary of Associated British Engineering, Limited.

SPEAKING AT WOLVERHAMPTON, recently, Prof. M. L. E. Oliphant, Professor of Physics at Birmingham University, expressed the belief that we shall see the application of atomic energy to industry within 10 years.

IN VIEW OF REDUCED PRICES of imported mild steel, the Eire Minister for Industry and Commerce has fixed new prices for certain descriptions of imported rods, squares, flats and angles. The new prices are £25 per ton, f.o.r., wholesale, and £30 per ton retail.

THE JOINT MEETING between the Chemical Engineering Group of the Society of Chemical Industry and the Institution of Chemical Engineers arranged for December 11 has been cancelled owing to the illness of Mr. Doxey, who was to have presented a Paper at the meeting.

A FEW TICKETS may still be obtained for the first annual dinner of the London branch of the Institute of British Foundrymen which is being held on December 7. Applications should be made to Mr. F. Arnold Wilson, Wm. Jacks & Company, Limited, Winchester House, Old Broad Street, London, E.C.2. Tickets are 17s. 6d. each.

WOMBWELL FOUNDRY & ENGINEERING COMPANY, LIMITED, propose to increase their authorised capital from £65,000 in 2s. shares (all issued) to £100,000, by the creation of a further 350,000 2s. shares. The chairman, Mr. J. H. Gourley, states that the directors consider that the increased capital should be available for issue in order to meet further capital expenditure, etc. Any offer of shares for cash will be made to the shareholders.

AT THE ANNUAL MEETING of Samuel Osborn & Company, Limited, held at Sheffield, recently, Sir Samuel Osborn, the chairman, gave details of the expansion of plant and improvement or addition to buildings achieved during the war years. The largest item had been the erection of the new Mushet Tool Works. Mills, forges and heat-treating plant had been added to or developed. The steel foundry had been much enlarged, including the addition of a 6-ton electric steel-melting furnace.

EIGHTY EMPLOYEES OF Irish Steel, Limited, Haulbowline, Co. Cork, received dismissal notices recently, and the number retained has been reduced to a minimum. Hundreds of tons of finished products are at present lying at Haulbowline awaiting delivery to various parts of the country. It is only two months ago that a steamer from Canada landed 3,500 tons of steel billets for Haulbowline, and it was then hoped that the industry there would be kept in constant production for many months.

GLENFIELD & KENNEDY, LIMITED, of Kilmarnock, have installed baths for the use of the workers in their foundries. This is said by our Scottish representative to be the first industrial works—apart from collieries—to be so equipped in the West of Scotland. Individual lockers—an important feature—have also been installed. This situation is rapidly being improved, however, and the Carron Company have installed spray baths at their Mill Foundry at Falkirk. The Mungal Foundry, Falkirk, is to have similar facilities. M. Cockburn & Company, Limited, Gowan Bank Ironworks, Falkirk, have also announced that their plans for baths and washing facilities, with rooms for changing and drying clothes, etc., for moulders and other workers, have been approved.

COMPANY RESULTS

(Figures for previous year in brackets.)

F. H. Lloyd & Company—Interim dividend of 3% (same).

J. Stone & Company—Interim dividend of 10% (same).

W. G. Allen & Sons (Tipton)—Interim dividend of 2½% (same).

Birmid Industries—Dividend of 10% and a bonus of 10%, making 20% (same).

Carrier Engineering—Profit for the year to June 30 last, £92,876 (£91,380); dividend of 25% (same).

Walter Spencer & Company—Net profit for the year ended September 30, £9,681 (£11,795); final dividend of 7½%, making 12½% (same).

Zinc Corporation—Interim dividend of 1s. (English currency) per ordinary share and per unit of ordinary stock in respect of 1945, less tax at 5s. 3d.

Cannon Iron Foundries—Profit for the year ended June 30, £56,692 (£81,284); taxation, £32,639 (£45,501); ordinary dividend of 10% (same).

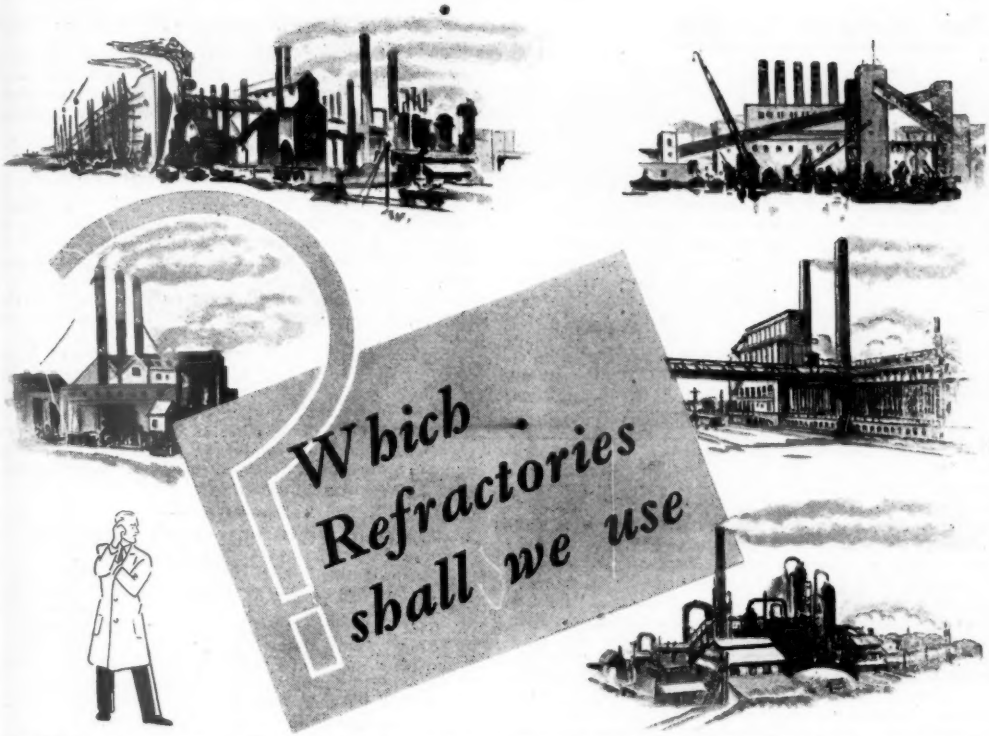
Premier Metal Company of South Africa—Net profit for the year ended June 30, £8,474 (£15,546); tax, £4,622 (£1,399); dividend of 8½% (6½%), £9,583 (£7,187); forward, £8,116 (£16,506).

Imperial Smelting Corporation—Net profit for the year ended June 30, after income-tax and E.P.T., £119,548 (£119,524); dividend of 4%, less tax, at 9s. 11d. (same); forward, £54,791 (£54,244).

Wombwell Foundry & Engineering—Profit for the year ended July 31, £15,096 (£15,902); tax, £6,106 (£4,599); depreciation, £2,000 (tax reserve £4,500); dividend of 16%, £5,200 (same); forward, £7,747 (£6,407).

Tube Investments—Final dividend on the ordinary stock of 12½%, and at the same rate relatively on the liaison ordinary shares, making 22½% (same); plus a special distribution of 10% (nil) out of the war contingencies reserve.

R. & W. Hawthorn, Leslie—Profit for the year ended June 30, including income from investments and after providing for depreciation, taxation and contingencies, £127,515 (£131,336); dividend of 10%, together with a bonus of 5% (same); to general reserve, £50,000 (same); forward, £51,980 (£56,043).



THE choice of refractories must be preceded by an assessment of furnace working conditions, temperatures, etc. When this information is available, engineers can select from the comprehensive "Glenboig" range of refractories a firebrick particularly suited to the furnace under consideration. Full recommendations concerning the use of the various "Glenboig" brands are given in the "Glenboig" catalogue *(copy on request)* and Glenboig technicians are always available to give advice on the application of their materials. "Glenboig" products are made from raw material of specially selected quality, in works equipped with the most up-to-date equipment and by processes subjected to strict laboratory control.

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GLENBOIG SPECIAL CROWN
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GLENBOIG CROWN · CASTLECARY
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Raw Material Markets

IRON AND STEEL

Pig-iron production is carefully related to current needs. Users of foundry grades are not permitted to buy for stock, but deliveries are adequate for immediate requirements, and more blast furnaces can be put into production if the need should arise. Large quantities of light castings will certainly be required for the housing drive and producers are promised maximum employment for some years to come. Moderate activity is maintained in the engineering and jobbing foundries, but there are indications of a gradual emergence from the period of transition from war to peace conditions.

Relief of the tightness of supplies of re-rolling material is now in sight. The first deliveries of billets purchased by the Control from the Dominions are now coming to hand and further substantial tonnages are expected. These arrivals are well timed. A big volume of orders has been placed for sheets, light bars and sections, and strip, the production of which calls for bigger tonnages of semis than the British steelmakers are able to provide. The moral seems to be that post-war reconstruction plans must embrace a further increase in ingot capacity.

Every department of the steel industry is now fully engaged. All the melting furnaces are working to capacity and most of the mills have so much work on hand that they are indicating delayed delivery dates. This applies particularly to steel plates, light sections and sheets. Until quite recently the plate mills were in quest of work. Now they have very healthy order-books and there are abundant outlets overseas for any supplies which are available after essential home needs are supplied. Large tonnages of railway and colliery equipment are on order and sheet makers have long waiting lists.

NON-FERROUS METALS

During the month of September, American users consumed 85,925 short tons of copper, compared with 104,783 tons in August. This decrease in consumption is attributed to strikes. Nevertheless, consumers' stocks of copper stood at 358,582 short tons, some 17,000 tons less than in the previous month. A reduction in the U.S.A. copper programme for 1946 is contemplated. An estimate puts the probable reduction at 50 per cent. Canadian production of new copper in August was 39,480,312 lbs., a decrease of 2,909,336 lbs. on the previous month.

Some interesting facts given by Mr. J. D. Small, chief of the American Civilian Production Administration, show that by strict conservation, only 2 lbs. of tin are used in the manufacture of a motor-car. Prior to the war a total of 7 lbs. was used. The stocks of tin discovered in Malaya are to be examined, before the metal is shipped out of the country. This is because of the possibility of the tin, manufactured during the Japanese occupation, being of an inferior quality.

The retention of restrictions on the use of lead is being urged in the United States, where next year's demand threatens to exceed the supply substantially. The country's estimated lead stocks at the beginning of 1946 are put at 88,000 tons.

A NEW UNIVERSAL BEAM MILL

A new universal beam mill, the first in this country, and a new steel plant are to be built on Tees-side by Dorman, Long & Company, Limited, at a cost of about £8,000,000. Announcing details of the scheme, the company state that the new installations will be erected on a site of 650 acres between their existing Cleveland and Redcar works at the mouth of the river Tees.

Approximately 23,000 tons of machinery and 14,500 tons of steelwork will be used in constructing the new mill and an additional 17,500 tons of steel will be used in building the open-hearth steel plant. In the most favourable circumstances a minimum of two years will be required to complete the new works, including the universal beam mill with blooming mill, steel plant and auxiliaries.

PARTING POWDERS AND SANDS IN FOUNDRIES

In pursuance of the statutory procedure under the Factories Act, 1937, the Minister of Labour and National Service has given notice that he proposes to make special regulations prohibiting the use, in factories in which metal castings are made, of parting powders or parting sands containing compounds of silicon calculated as silica to the extent of more than 3 per cent. by weight of the dry material.

Copies of the draft special regulations, entitled the Foundries (Parting Powders) Special Regulations, 1945, can be obtained from H.M. Stationery Office or through any bookseller.

THE SHAREHOLDERS of the Scottish Stamping & Engineering Company, Limited, have approved the creation of 1,000,000 new 2s. ordinary shares and the offer of 703,320 of them at 3s. 6d. each to existing holders in the proportion of one for every ordinary share held.

IN ACCORDANCE WITH THEIR PRACTICE, Glenfield & Kennedy, Limited, hydraulic engineers and founders, of Kilmarnock, have presented gold medals to two employees with over 50 years' service. There are now nine gold medallists in the service of the firm and 30 retired on pensions.

FOUNDRY SERVICES, LIMITED, inform us that, while their registered trade mark "Foseco" has been accepted to cover coke forks, corundum and emery wheels, moulding and stamping tools, etc., they are not suppliers of these articles, nor are they proposing to market foundry requisites of the type mentioned.